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Art. IV.—*Notes on a Callus Shoot of Eucalyptus ovata and E. diversifolia.*

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For many years experiments have been carried out by Professor Ewart on the grafting of Eucalypts by splitting seedlings in two and grafting them along their length by the in-arching method but allowing the roots of both plants to persist. In this way, shoots of both parents were able to develop, as were also shoots at the line of union. In one of these "siamese-twin" grafts of *Eucalyptus ovata* and *Eucalyptus diversifolia* at the line of demarcation a shoot developed which was apparently a callus shoot. The leaves of this shoot appeared to be intermediate in shape between the leaves of both parents. In many Eucalypts a considerable degree of variation is shown in the leaves of different shoots of the same plant, according to the ages of the branches bearing the leaves, hence it was necessary to determine by precise observation whether the shape of the leaves on the callus shoot was due to its relative youth or to any influence exercised on it by either of the two parent stems. Accordingly measurements were made over a period of two years at intervals of three months. The length and breadth of 50 leaves of both parents and of the callus shoot were measured each time, and the average taken. The ratio of length to breadth was used as the basis of comparison. The leaves measured each time were, as far as possible, from shoots of a similar age. After the first measurement, the callus shoot, which had been growing in an upright position, was lowered horizontally to determine whether the shape of the leaves was affected in any way by the position of the branch. The branch was in this lowered position during the remainder of the measurements. After the sixth and last measurement, the branch was raised to its original upright position. Some time after this, however, before any further measurements could be made, the branch died. Its death could not be accounted for.

The following tables give the measurements made. In Table I. mature leaves were measured, while in Table II. only young ones were used. The measurements given in Table I., sections 1, 2, and 3, were made in June, September, and December, 1930, respectively; while those in Table II. were made in April, July, and October, 1931.

In the three sections of Table I. it can be seen that the leaves of the callus shoot are intermediate in shape between the leaves of both parents, while in Table II. the ratio of the callus shoot drops below that of *E. ovata*, leaving *ovata* in the intermediate position. Thus it seems that the young leaves of the parents have

TABLE I.

	Mature Leaves	Average Length, cm.		Average Breadth, cm.		L/B.
June 1930	E. ovata	11.4	..	4.1	..	2.78
	Callus shoot (upright) . .	12.0	..	3.95	..	3.04
	E. diversifolia	11.0	..	2.9	..	3.79
Sept. 1930	E. ovata	11.13	..	4.46	..	2.49
	Callus shoot (lowered) . .	10.4	..	3.03	..	3.43
	E. diversifolia	10.38	..	2.55	..	4.07
Dec. 1930	E. ovata	10.97	..	3.79	..	2.89
	Callus shoot (lowered) . .	10.54	..	3.31	..	3.18
	E. diversifolia	10.42	..	2.86	..	3.64

TABLE II.

	Young Leaves	Average Length, cm.		Average Breadth, cm.		L/B.
April 1931	E. ovata	8.9	..	3.02	..	2.95
	Callus shoot (lowered) . .	8.94	..	3.46	..	2.56
	E. diversifolia	10.36	..	2.72	..	3.8
July 1931	E. ovata	10.76	..	3.53	..	2.89
	Callus shoot (lowered) . .	9.26	..	3.19	..	2.59
	E. diversifolia	9.72	..	2.69	..	3.61
Oct. 1931	E. ovata	10.56	..	3.72	..	2.84
	Callus shoot (lowered) . .	9.22	..	3.46	..	2.66
	E. diversifolia	9.23	..	2.62	..	3.5

approximately the same shape as the old leaves, i.e., the ratio of length to breadth is approximately constant, while in the callus shoot there is a marked difference. There is no evidence to show whether this difference is due to the age of the leaves or to the lowering of the branch.

In the case of *E. ovata*, further measurements were made to compare the shape of young leaves growing on new shoots developed out of the natural order with that of young leaves growing on normally developed shoots. Again 50 of each were measured, and the average taken. The following were the measurements:

	Average Length, cm.		Average Breadth, cm.		L/B.
Young leaves on old shoots . . .	9.56	..	3.26	..	2.96
Young leaves on new shoots . . .	8.5	..	4.71	..	1.8

From an examination of all the figures, it can be seen that the ratio of length to breadth in the young leaves developed on old

shoots is similar to the ratios found in all previous measurements of *E. ovata,* but the ratio of leaves on newly-developed shoots is very different.

According to Yapp and Mason (1), the water content of leaves at the same stage of development on the whole decreases with the height of the plant. These writers also point out that Zalinsky showed conclusively that the structure of the leaves of ordinary herbaceous plants is a function of the position of the leaves on the stem. In view of these statements, it seems likely that the variation in the shape of the leaves shown by the last table may be due to the water content of the leaves. The young leaves on the shoot developing lower down the trunk and out of the natural order will have a higher water content, and will therefore be of a more hygrophilous nature than the young leaves on the shoots developed higher up the tree in the normal order. These latter leaves will be more xerophilous in character, and will, therefore, to some extent, vary in shape from the previous ones. Also, since the callus shoot developed at a lower level than the parent shoots from which the leaves measured were taken, it is quite possible that the water content in the leaves of the callus shoot was higher than in those of the parents, and to this was due the variation in the shape of the leaves. Unfortunately, the callus shoot died before this paper was brought to my notice, and further experiments were impossible. Although no definite evidence could be obtained as to whether the shape of the leaves was affected by altering the position of the branch, it is possible that, in a horizontal position, the terminal leaves might have a relatively higher water content which during their development might cause some change in their usual shape.

From these results it can be seen that there is not sufficient evidence to show that the variation in shape of the leaves of the callus shoot was due to any influence exercised on it by the two parent stems from between which it grew. Although it appeared to have developed definitely as a callus shoot at the point of union, its range of variation of leaves was very nearly within that shown by the leaves of *E. ovata,* and hence no conclusive evidence is to be deduced from these observations to show that the parents in a graft can effect the structure of a shoot growing at the point of union.

Bibliography.

1. Yapp and Mason. The Distribution of Water in the Shoots of Certain Herbaceous Plants. *Ann. Bot.*, xlv, No. 181, 1932.